

## UNITARY LIFTGATE

### 10 BACKGROUND OF THE INVENTION

#### Field of the Invention

The present invention relates to liftgates used to bring loads to and from  
15 ground level and the level of a vehicle's payload area.

#### Description of the Related Art

Liftgates are typically mounted at the rear of trucks, truck trailers and the like  
20 to bring payloads from ground level up to the bed of the truck or from the bed to the  
ground. In some applications, it is desirable to configure the liftgate so that it folds  
away when not in use. Examples of such designs are the cantilever Tuk-A-Way®  
liftgates available from Maxon (Santa Fe Springs, CA), assignee of the current  
invention. Typically, these liftgates employ parallelogram linkages to maintain the  
25 liftgate in a horizontal plane through the lifting range. The liftgate is attached to the  
parallelogram linkages by pivot members, which allow the liftgate to be placed in a  
generally vertical position when in the lowered position. When in the vertical  
position, operation of the lifting mechanism rotates the liftgate into an inverted,  
stowed position beneath the vehicle body.

30 Prior art Tuk type cantilever liftgates present various challenges having to do  
with their shipping and installation. All prior art Tuk type cantilever liftgates mount  
to the vehicle chassis. Thus, these liftgates are susceptible to misalignment with the  
vehicle body. When misaligned, operation of the liftgate can exert differential force

5 on the vehicle body and truck body, tending to separate them. Further, typical cantilever liftgates, when shipped from the factory, are partially disassembled and have awkward shapes, requiring substantial packaging. Further, proper installation necessitates that several of the components must be precisely aligned and then securely mounted to the vehicle. Moreover, the liftgate must be fitted to the vehicle  
10 only after the truck body has been attached to the chassis. Consequently, proper installation of prior art liftgates involve significant time and expense.

Accordingly, what has been needed is a Tuk type cantilever liftgate design configured for easy shipping that simplifies installation while improving overall strength and reliability. This invention satisfies these and other needs.

## **SUMMARY OF THE INVENTION**

The system of the invention is a pre-assembled, unitary Tuk type cantilever liftgate comprising an opposing pair of side plates, an extension plate extending  
20 between the side plates, a hydraulically driven lift frame pivotally attached to the side plates and a liftgate platform rotatably attached to the lift frame wherein the liftgate is configured to be secured only to a vehicle body. In preferred embodiments, the side plates and extension plate are configured so that liftgate system can be attached to the vehicle body by bolts, welding or the like. The side  
25 plates may further comprise steps, brackets and bumpers. Also preferably, the lift frame may comprise a lift frame tube configured to function as an underide guard. The unitary liftgate may also be configured to allow multiple units to be stacked together to facilitate shipping and storage.

The invention also comprises the unitary liftgate system secured to a vehicle  
30 body. This lift gate may be fully assembled and tested prior to being secured to the vehicle body. Further, since the liftgate is secured to the vehicle body, it can be attached prior to the body being secured to the vehicle chassis. The features of the

- 5 invention allow the liftgate to be installed in significantly less time than prior art cantilever liftgates.

## BRIEF DESCRIPTION OF THE DRAWINGS

10 The aforementioned advantages of the invention, as well as additional advantages thereof, will be more fully understood in light of the detailed description of the invention below when taken in conjunction with the accompanying drawings in which:

FIG. 1 is an elevational view of the inventive liftgate shown with the liftgate platform in the stowed position;

FIG. 2 is an elevational view of the liftgate platform lowered to the vertical position;

FIG. 3 is a side view of the liftgate platform in the lowered position with the liftgate platform extended;

FIG. 4 is an elevational view of the liftgate platform in the raised position with the liftgate platform extended;

FIG. 5 is a side view of the liftgate in the raised position with the liftgate platform extended;

FIG. 6 is an elevational view showing the liftgate platform secured to a portion of the vehicle body.

FIG. 7 is an elevational view showing a plurality of inventive unitary, fully assembled liftgates stacked together to facilitate shipping, for example.

## DETAILED DESCRIPTION OF THE INVENTION

30 *sub B17* Figures 1-7 show the cantilever liftgate system 10 of the invention. The system comprises a framework 12 having side plates 14, a trunnion tube 16 extending between side plates 14 and an extension plate 18, also extending between

5 side plates 14. The structural members of liftgate 10 are preferably formed from steel, but other metals or composite materials can be suitable depending upon the intended application. The liftgate also comprises a lift frame 20 with a lift frame tube 22 extending between an opposing pair of parallelogram linkages 24 each having upper arms 26 and lower arms 28 with and proximal pivot members 30 and  
10 distal pivot members 32. Proximal pivot members 30 are attached to trunnion tube 16 thus securing lift frame 20 to framework 12. Preferably, trunnion tube 16 comprises integral mounts 34 for attaching proximal pivot members 30. Trunnion tube 16 also comprises cylinder tower 36. Hydraulic cylinder 38 is pivotally attached at either end to tower 36 and lift frame tube 22 to drive lift frame 20.  
15 Distal pivot members 32 are secured to liftgate platform 40 so that, together with proximal pivot members 30, upper and lower arms 26 and 28 form parallelogram linkages 24. The linkages 24 are configured to maintain the orientation of distal pivot members 32 to proximal pivot members 30 as upper arms 26 and lower arms 28 are raised and lowered. Retraction of hydraulic cylinder 38 drives lift frame tube 22, rotating upper arms 26 and lower arms 28 about proximal pivot members 30 to liftgate platform 40. Conversely, extension of hydraulic cylinder 38 raises liftgate  
20 platform 40.

Liftgate platform 40 is configured to be raised into either the load lifting position shown in Figs. 4 and 5 or the stowed position shown in Figs. 1 and 6.

25 Specifically, liftgate platform 40 is rotatably attached to distal pivot members 32 with motion limiting stops 44 that prevent rotation of liftgate platform 40 away from upper and lower arms 26 and 28 beyond the horizontal plane. This keeps liftgate platform 40 in a plane parallel with the ground and vehicle body 46 to facilitate loading and unloading. Alternatively, liftgate platform 40 may be rotated at distal  
30 pivot members 32 toward upper and lower arms 26 and 28 to the generally vertical position shown in Fig. 2. In this position, actuation of hydraulic cylinder 38 raises and inverts liftgate platform 40 until it is located in its stowed position shown in Figs. 1 and 6. As used herein, the term cantilever refers to liftgates having a

5 platform supported at one end only. For example, platform 40 is supported by the pivotal attachment to distal pivot members 32.

In a preferred embodiment, liftgate platform 40 is equipped with a liftgate platform extension 48 attached by hinge 50, creating a bifold configuration. Hinge 50 allows the liftgate platform extension to fold against liftgate platform 40 in the  
10 direction of the system 10, but prevents liftgate platform extension 48 from rotating beyond the plane of liftgate platform 40, thus providing a suitable lifting platform. Similarly, when liftgate platform 40 is placed into the vertical position shown in Fig. 2, liftgate platform extension 48 folds back against liftgate platform 40, providing a more compact profile for storage. In other embodiments, one or more additional  
15 platform extensions may be provided creating a trifold configuration, for example.

*Q17* Framework 12 preferably comprises a variety of additional features to simplify manufacture and to increase the utility of the liftgate system 10. For example, side plates 14 may comprise formed steps 50, pump bracket 52 for mounting pump 54 to power hydraulic cylinder 38, dock bumpers 56 and vehicle light brackets 58.

*Q18* Generally, these features are integral with the framework 12 but they can also be separate members that are suitably attached to the frame. Also preferably, lift frame tube 22 is configured to function as an underride guard to minimize injury in the event of a rear end collision. Integrating underride protection into the existing liftgate system removes the need for an additional, dedicated horizontal member.

*See Fig 6*  
25 Figure 6 shows framework 12 secured to vehicle body 46. Generally, extension plate 18 is secured to the rear lower horizontal frame member 60 of the vehicle and side plates 14 are secured to the rear lower horizontal frame member 60 and sub-structure cross members 62. Preferably, framework 12 is secured to the vehicle by bolts 64, but welding or other conventional means of attachment are also suitable. Since all the liftgate components are attached to the framework 12, only the framework 12 needs to be attached to the vehicle and no alignment or adjustment of the lifting mechanism will be necessary. Further, the unitary construction of the liftgate allows it to be attached to a wide variety of truck types,

5 since only the framework 12 need be secured. Typically, the only adjustment  
necessary is to level the extension plate 18 with the truck bed 66. This is easily  
accomplished by the use of shims 68 between side plates 14 and cross members 62.  
In short, this invention allows the integrated liftgate system 10 to be fully pre-  
assembled requiring only final bolt-on attachment to a vehicle body with little or no  
10 adjustment.

As an alternative embodiment framework 12 can be preattached to lower  
horizontal frame member 60 at the factory and shipped as a unitary lift assembly. In  
such an instance the framework 12, including lower horizontal frame member 60,  
would be attached on site to the rear of the vehicle by attaching sub-structure cross  
15 members 62.

The integrated, unitary and compact nature of the invention also facilitates  
shipping, packaging and storing. Framework 12 with the liftgate platform 40 in the  
stowed position presents a compact, box-like profile that may be stored or shipped  
with virtually no packaging. Further, multiple systems may be stacked and bolted  
together for shipment, avoiding or minimizing the need to use pallets, banding  
20 material, or other packaging means. For example, as shown in Figure 7, the bottom  
profile of the side plates 14 is configured to nest with the top profile of side plates  
14 and extension plate 18. This allows a stack of multiple liftgate units to be very  
stable and allows them to be easily secured together, by bolts or other suitable  
25 means.

Providing a unitary cantilever liftgate that attaches to the vehicle body rather  
than the vehicle chassis offers numerous benefits. First, the liftgate may be  
completely assembled and fully tested at the factory prior to being delivered for  
installment. This greatly improves quality control and simplifies installation. The  
30 liftgate need only be secured to the vehicle body by welding, bolting or other means,  
dramatically reducing the installation time required. Where prior art cantilever  
liftgates typically require 6 to 8 hours to install, the unitary liftgates of the invention  
can be installed in about 1 hour. Further, since the liftgates of the invention secure

5 to the vehicle body, the lift platform will always be in alignment with the body. Prior  
art liftgate designs, since they attach to the vehicle chassis, have lift platforms that  
may become misaligned with the vehicle body. Indeed, when the misalignment  
becomes severe, operation of the liftgate can exert a differential force on the vehicle  
body, causing it to separate from the vehicle chassis. In contrast, the inventive  
10 liftgates completely avoid such problems.

Described herein is a preferred embodiment, however, one skilled in the art  
that pertains to the present invention will understand that there are equivalent  
alternative embodiments.